



# Getting the Lowdown on Airborne Pollutants

Commercial Benefits—Spinoffs

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**R**emote sensing has been taken to new heights given the work of Opto-Knowledge Systems, Inc. (OKSI), of Torrance, California. Through a Small Business Technology Transfer (STTR) award from Goddard Space Flight Center, the company, with the support of NASA's Jet Propulsion Laboratory as the collaborating Research Institute sub contractor, has pushed the frontier of neural network technology for very fast analysis of hyperspectral imagery. The company is also honing the technology of spectral imaging for commercial applications in agriculture, geology, medical diagnosis, manufacturing, and other fields.

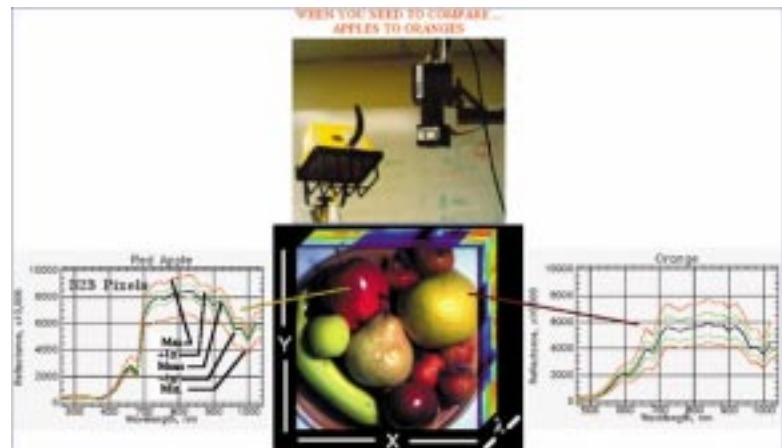
The product of a spectral imaging system is a stack of images of the same object or scene, each at a different spectral narrow band, or color. To take full advantage of a hyperspectral system, components must be carefully integrated. Furthermore, special algorithmic tools are needed to analyze and visualize data collected, integrating the entire system into a smoothly functioning instrument.

OKSI has made possible turnkey bench top hyperspectral systems for field or laboratory use. Applications of its hyperspectral camera technology include remote sensing in agriculture, geology, and for military needs, produce and meat inspection, and forensics. Since its establishment in 1991, OKSI has built custom imaging spectrometers in the visible/near infrared and mid-wave infrared portions of the electromagnetic spectrum.

OKSI's Spectral Imaging System is commercially available, with the hardware custom configured for the end-user's needs and requirements. Under Goddard's STTR project, OKSI furthered the advancement in spectral imaging, resulting in several commercial products. Such products include a turnkey bench top hyperspectral imaging system, containing everything the user needs to start applying hyperspectral imaging. The system incorporates the sensor, optics, computer interface, and a versatile hyperspectral analysis software package.

A system sold to a major automobile manufacturer, for example, uses two cameras for stereo imaging and features customized parts and software.

OKSI participated in NASA's Visiting Investigator Program (VIP) under the Commercial Remote



*OptoKnowledge Systems, Inc.'s hyperspectral imaging system can be used in applications such as food inspection.*

Sensing Program Office at Stennis Space Center. This effort assessed the suitability of thermal infrared imaging data for the remote detection of pollutants and hazardous substances. Stennis remote sensing and OKSI experts worked together to collect data from an aircraft-carried instrument that flew over various areas, including oil refineries and industrial, residential, and agricultural sites. The data were then analyzed, and ground temperature and emissivity maps were generated. Such maps are fundamental requirements for airborne remote detection of pollutants, either in the atmosphere or in the ground, because their spectral signatures are measured against the Earth's background.

As part of this effort, OKSI acquired the spectra of the 189 most hazardous air pollutants as defined by the Clean Air Act Amendment of 1992 and listed by the Environmental Protection Agency. The high-resolution spectra obtained were then processed to demonstrate the capability of a prototype Thermal Infrared Imaging Spectrometer sensor to detect such gases.

OKSI is continuing its work with Stennis. In September 1998, OKSI was selected by Stennis for a 2-year program to demonstrate the use of hyperspectral data in precision agriculture.

This type of research work carried out by OKSI is assisting NASA in developing a suite of airborne and satellite remote sensing applications to study the oceans, biosphere, atmosphere, and land surface. Through the use of algorithmic techniques and data processing, furthered by OKSI's expertise, new ways to assess the health and well-being of the Earth are possible, as are various commercial applications, from resource monitoring to medical diagnosis. ♦